SPECIFICATION

# IGNITION DEVICE FOR IMPROVING IGNITION SPARK INTENSITY FOR A PLUG CORD FOR AN INTERNAL COMBUSTION ENGINE AND DIRECT IGNITION SYSTEM FOR AN INTERNAL COMBUSTION ENGINE, AND METHOD FOR CONNECTING THE SAME

## BACKGROUND OF INVENTION

### Field of Invention

The present invention relates to ignition of an ignition plug or spark plug for an internal combustion engine. Its object is to improve ignition spark intensity for an ignition plug or spark plug and improve burning efficiency by providing or constituting an ignition device for a spark plug cord for an internal combustion engine and for direct ignition for an internal combustion engine.

### Background Art

As shown in FIG. 1, with a conventional plug cord for an internal combustion engine, ignition spark intensity could not be easily improved because of a high resistance value imparted by carbon, Kevlar, or a variable pitch wire core 2, and such plug cord was given a function that

worked against the function of transmitting electricity, which is the primary objective for a plug cord.

As shown in FIG. 2, in conventional direct ignition system for an internal combustion engine, in order to save space in the engine compartment, plug cords are not used, and plugs are provided with ignition coils 8, 9.

However, because of space-saving requirements, there are restrictions on size, coil capacity is restricted, and ignition spark cannot be efficiently intensified.

## SUMMARY OF THE INVENTION

With the conventional art for a plug cord for an internal combustion engine, it is possible to improve ignition spark intensity by making resistance as small as one wants; however, such an ignition system causes radio frequency interference, and ignition noise can interfere with a combustion control device or audio device.

Thus a goal of the present invention is to provide an ignition device that enables ignition spark intensity to be improved without changing the voltage boosting device for an ignition plug cord for an internal combustion engine.

With the conventional art for a plug cord for an internal combustion engine, it is possible

to improve ignition spark intensity by increasing voltage of supplied power; however, because plug cord length differs depending on cylinder position, this serves to promote combustion efficiency degradation caused by the unevenness of ignition spark intensity among the cylinders, improvement of which has long been a technical goal.

Thus a further goal of the present invention is to provide an ignition device that enables each cylinder to have uniform ignition spark size without changing the voltage boosting device for an ignition plug cord for an internal combustion engine.

With the conventional art for a plug cord for an internal combustion engine, it is possible to improve ignition spark intensity by increasing ignition coil capacity; however, this works against the goal of saving space and, squeezing coils into a limited space causes such problems as heating, resulting in combustion troubles.

Thus a goal of the present invention is to provide an ignition device that enables ignition spark to be intensified without changing the voltage boosting device for direction ignition for an internal combustion engine.

To meet the aforementioned goals, a first aspect of the present invention is an ignition device wherein noise at time of fuel ignition caused by a plug cord for an internal combustion engine is suppressed and ignition spark intensity is improved.

A second aspect of the present invention is an ignition device that improves ignition spark intensity in a state such that the space-related merits are taken advantage of at time of fuel ignition in direct ignition for an internal combustion engine.

A third aspect of the present invention is an ignition device according to either the first or second aspects, that improves ignition spark intensity by efficiently storing counter electromotive force as electrostatic energy and discharging the same.

A fourth aspect of the present invention is an ignition device according to the second aspect that improves ignition spark intensity by efficiently storing counter electromotive force as electrostatic energy and discharging the same.

A fifth aspect of the present invention is an ignition device enabling improvement of ignition spark intensity while improving combustion efficiency by making the ignition spark output uniform in each cylinder in a multi-cylinder internal combustion engine.

A sixth aspect of the present invention enables improvement of ignition spark intensity through use of a plurality of ignition devices in an internal combustion engine.

A seventh of the present invention enables further improvement of ignition spark intensity by efficiently storing counter electromotive force as electrostatic energy and discharging the same.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a lateral view showing a simplified full aspect of a conventional plug cord for an internal combustion engine, as well as the main components thereof.

FIG. 2 is a lateral view showing a simplified full aspect of a conventional direct ignition system for an internal combustion engine, as well as the main components thereof.

FIG. 3 is a lateral view showing a simplified full aspect of an embodiment of the present invention, as well as the main parts thereof, as used in a plug cord for an internal combustion engine.

FIG. 4 is a lateral view showing a simplified full aspect of an embodiment of the present invention, as well as the main parts thereof, as used in a direct ignition system for an internal combustion engine.

FIG. 5 is a lateral view showing a simplified full aspect of an embodiment of the present invention, as well as the main parts thereof, as used in a direct ignition system for an internal combustion engine.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the present invention will be explained with reference made to the drawings.

FIG. 3 shows a first embodiment of the present invention which comprises an internal combustion engine plug cord body 1. From an ignition plug attachment hardware 3, an anode 13 extends so as to be connected thereto or to be in contact therewith. This anode 13 is covered with an insulating material 14, and is further covered with a cathode 11, and is still further covered with an insulating body 12. Thereafter, a terminal 10 is attached to a tip of the cathode 11. The terminal is connected to, or comes in contact with, an internal combustion engine ground.

In accordance with this embodiment, the ignition spark intensity is improved through the workings of the anode 13, insulating material 14, cathode 11, insulating body 12 and terminal 10. In addition, by changing the length or resistance of the resistor anode 13, the ignition spark intensity for each cylinder can be made uniform. Accordingly, this improves internal combustion

engine combustion efficiency and leads to reduction of exhaust gases.

FIG. 4 shows another embodiment of the present invention which comprises an internal combustion engine direct ignition system main body 2, 3, 8, 9, 13. From an ignition plug attachment hardware 3, an anode 13 extends so as to be connected thereto or to be in contact therewith. This anode 13 is covered with an insulating material 14, and is further covered with a cathode 11, and is still further covered with an insulating body 12. Thereafter, a terminal 10 is attached to a tip of the cathode 11. The terminal is connected to, or comes in contact with, an internal combustion engine ground.

In accordance with this embodiment, ignition spark intensity is improved through the workings of the anode 13, insulating material 14, cathode 11, insulating body 12 and terminal 10. Accordingly, this improves internal combustion engine combustion efficiency and leads to reduction of exhaust gases.

FIG. 5 shows another embodiment of the present invention which comprises an internal combustion engine direct ignition system main body 2, 3, 8, 9, 13. From an ignition plug attachment hardware 3, an anode 13 is connected or is in contact with a connection part 15, and covers an ignition coil B. This anode 13 is covered with an insulating material 14, and is further covered with a cathode 11, and is still further covered with an insulating body 12. Thereafter, a

terminal 10 is attached to a tip of the cathode 11. The terminal is connected to, or comes in contact with, an internal combustion engine ground.

In accordance with this embodiment, ignition spark intensity is improved through the workings of the anode 13, insulating material 14, cathode 11, insulating body 12 and terminal 10. Accordingly, this improves internal combustion engine combustion efficiency and leads to reduction of exhaust gases.

In the embodiments of FIGS. 3, 4 and 5, the ignition spark intensity is improved through the workings of the anode 13, insulating material 14, cathode 11, insulating body 12 and terminal 10. Alternatively, connection to or contact with the anode 13 may be made at an intermediate point of the ignition plug attachment hardware 3 or the core wire 2.

As described above, the present invention enables ignition spark intensity to be improved without changing a voltage boosting device for a plug cord for an internal combustion engine or direct ignition for an internal combustion engine.

Explanation of the Numerals

1, plug cord; 2, core wire; 3, ignition plug attachment hardware; 4, plug cap; 5, distributor

connection hardware; 6, cap; 7, spark plug; 8, ignition coil B; 9, ignition coil A; 10, terminal; 11, cathode; 12, insulating body; 13, anode; 14, insulating material; 15, connecting part.